Claims

[1] A solvent-free polymer electrolyte comprising:
a porous film having a first surface and a second surface, the porous film comprises a reticulated network of channels formed between pores on the first and second surfaces, and is made of a mixture comprising a first polymer and a second oligomer , the first polymer being at least one selected from the group consisting of poly(vinylidene fluoride-co-hexafluoropropylene) copolymers, polyvinylidenefluorides, polymethylmethacrylates, polyacrylonitriles, polyethyleneoxides, and celluloses having a polyether chain, the second oligomer being at least one selected from the group consisting of poly(ethylene oxide-co-ethylene carbonate) copolymers with at least one terminal groups substituted by a halogen atom and polyethyleneglycols with at least one terminal groups substituted by a halogen atom, and each of the first polymer and the second oligomer being present in the mixture in an amount capable of forming a single phase; and
an electrolyte present in the pores of the porous film and comprising the second oligomer and a lithium salt.

[2] The solvent-free polymer electrolyte of claim 1, wherein the weight ratio of the first polymer to the second oligomer is in the range of 95 :5 to 35 :65.

[3] The solvent-free polymer electrolyte of claim 1, wherein in the poly(ethylene oxide-co-ethylene carbonate) copolymer, the molar ratio of ethylene oxide unit to ethylene carbonate unit is in the range of 9:1 to 1:9.

[4] The solvent-free polymer electrolyte of claim 1, wherein the lithium salt is at least one selected from the group consisting of $LiPF_6$, $LiBF_4$, $LiClO_4$, $LiCF_3SO_3$, $LiC_4F_9SO_3$, $LiN(CF_3SO_2)_2$, $LiAsF_6$, and $LiN(SO_2C_2F_5)_2$.

[5] The solvent-free polymer electrolyte of claim 1, wherein the porous film and/or the electrolyte further comprises an inorganic filler.

[6] The solvent-free polymer electrolyte of claim 5, wherein the inorganic filler is at least one selected from the group consisting of titanium dioxide (TiO_2), silicon dioxide (SiO_2), alumina (Al_2O_3), lithium aluminate (gamma -$LiAlO_2$), and zeolite.

[7] A secondary battery comprising:
an anode comprising a carbonaceous material;
a cathode comprising a compound enabling intercalation and deintercalation of lithium; and
a solvent-free polymer electrolyte interposed between the cathode and the anode, wherein the solvent-free polymer electrolyte comprises:

a porous film having a first surface and a second surface, the porous film comprises a reticulated network of channels formed between pores on the first and second surfaces, and is made of a mixture comprising a first polymer and a second oligomer, the first polymer being at least one selected from the group consisting of poly(vinylidene fluoride-co-hexafluoropropylene) copolymers, polyvinylidenefluorides, polymethylmethacrylates, polyacrylonitriles, polyethyleneoxides, and celluloses having a polyether chain, the second oligomer being at least one selected from the group consisting of poly(ethylene oxide-co-ethylene carbonate) copolymers with at least one terminal groups substituted by a halogen atom and polyethyleneglycols with at least one terminal groups substituted by a halogen atom, and each of the first polymer and the second oligomer being present in the mixture in an amount capable of forming a single phase; and

an electrolyte present in the pores of the porous film and comprising the second oligomer and a lithium salt.

[8] The secondary battery of claim 7, wherein the weight ratio of the first polymer to the second oligomer is in the range of 95:5 to 35:65.

[9] The secondary battery of claim 7, wherein in the poly(ethylene oxide-co-ethylene carbonate) copolymer, the molar ratio of ethylene oxide unit to ethylene carbonate unit is in the range of 9 :1 to 1: 9.

[10] The secondary battery of claim 7, wherein the lithium salt is at least one selected from the group consisting of $LiPF_6$, $LiBF_4$, $LiClO_4$, $LiCF_3SO_3$, $LiC_4F_9SO_3$, $LiN(CF_3SO_2)_2$, $LiAsF_6$, and $LiN(SO_2C_2F_5)_2$.

[11] The secondary battery of claim 7, wherein the porous film and/or the electrolyte further comprises an inorganic filler.

[12] The secondary battery of claim 11, wherein the inorganic filler is at least one selected from the group consisting of titanium dioxide (TiO_2), silicon dioxide (SiO_2), alumina (Al_2O_3), lithium aluminate (gamma -$LiAlO_2$), and zeolite.

[13] The secondary battery of claim 7, wherein the compound enabling intercalation and deintercalation of lithium is at least one selected from the group consisting of $LiCoO_2$, $LiMnO_2$, $LiNiO_2$, $LiCrO_2$, and $LiMn_2O_4$.